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Factsheet

Pest Management Program for Grape Series

DOWNY MILDEW OF GRAPE

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Downy mildew of grape is a disease, native to North America, caused by the fungus, *Plasmopara viticola*. This disease infects most species of *Vitis* (grape) with vinifera cultivars being highly susceptible, and wild species relatively resistant. Downy mildew may injure grapes directly by causing deformed shoot, tendril and cluster growth (Figure 1) or by premature defoliation resulting in delayed ripening of fruit and increased vine sensitivity to winter injury. The symptoms of downy mildew and strategies for its control are different from those of Powdery mildew, caused by the fungus *Uncinula necator*. For a complete description of Powdery mildew, see OMAF Factsheet, *Powdery Mildew of Grapes,* Agdex 231/634.

Figure 1. Downy mildew on grape cluster.

BIOLOGY

Downy mildew overwinters as oospores chiefly within fallen leaves in and around the vineyard (see Life Cycle diagram). In early spring, as soon as temperatures reach 11°C, the oospores germinate in water to form sporangia. Within sporangia are zoospores (sometimes known as swimming spores) which are dispersed onto host grape tissue by rain splash.

Zoospores can germinate under optimum conditions (18 to 24°C and free moisture) in less than 90 minutes. They penetrate the lower surface of young leaves, shoots and tendrils through the stomata (tiny openings for air exchange on the host tissue). Once inside the host tissue, the fungus spreads throughout the tissue and during humid or wet warm weather it erupts to produce a white cottony growth of mycelium on the bunch rachis or on the lower leaf surface. This white or greyish mycelial growth produces new sporangia and during rain zoospores will be released and spread by rain to other host tissue, causing new infections. Depending on weather conditions and cultivar susceptibility, symptoms may be observed within 5 days of the initial infection. Continued development of downy mildew during the season depends on the frequency of suitable wetting periods and the presence of susceptible host tissue. Late season infections can develop during prolonged heavy dew or fog. At the end of the growing season, oospores form within diseased leaves and over winter on the vineyard floor until they germinate the following spring.

CROP DEVELOPMENT STAGES AND DISEASE SYMPTOMS

Figure 2. Mildew lesion on upper surface of leaf.

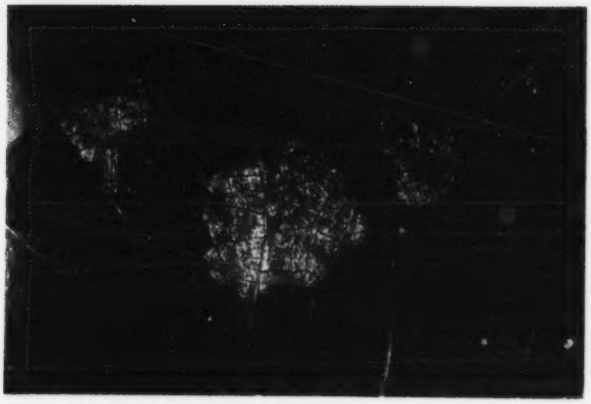


Figure 3. White, "downy" sporulation on lower surface of the leaf.

1. Budbreak to Prebloom Leaf infection.

During periods of cool temperatures (11 to 24°C) and prolonged wet conditions, downy mildew lesions will appear as small greenish-yellow spots on the upper surface of the leaf (Figure 2). Numerous lesions coalesce to form brown, mottled areas. On the lower surface of the leaf, a white, "downy" sporulation develops resembling a felt-like patch (Figure 3). Severely infected leaves may wither or curl then fall from the vine.

2. Prebloom Shoot and Cluster infection.

When infected, young shoots and clusters often become stunted, distorted and thickened. This tissue becomes white with sporulation and twists or curls giving a "pigtail" appearance (Figure 4). Severely infected clusters and shoots usually wither and die.

Figure 4. Infection on shoot causing growth distortion and curl.

3. Post Bloom Cluster infection.

Spores from nearby infected shoots and leaves may be splashed or washed onto the berries while the fruit is about pea size. Young berries will turn light brown, become soft then shatter or fall off the cluster easily. Heavily infested clusters will be covered with white sporulation and exhibit the chracteristic "pig tail curl" shape (Figure 5).

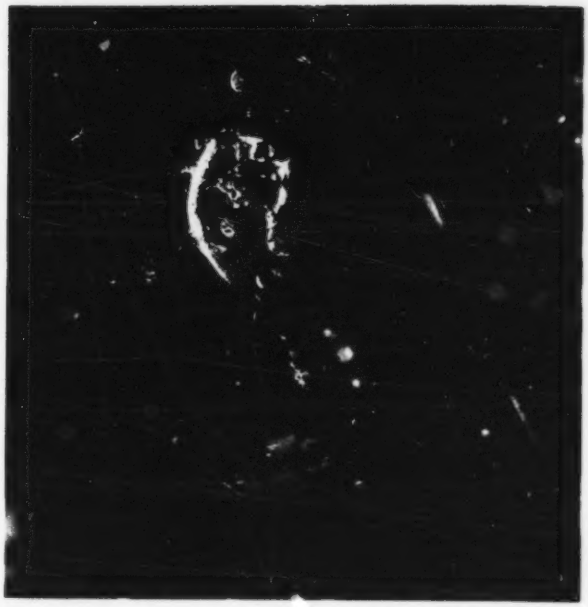
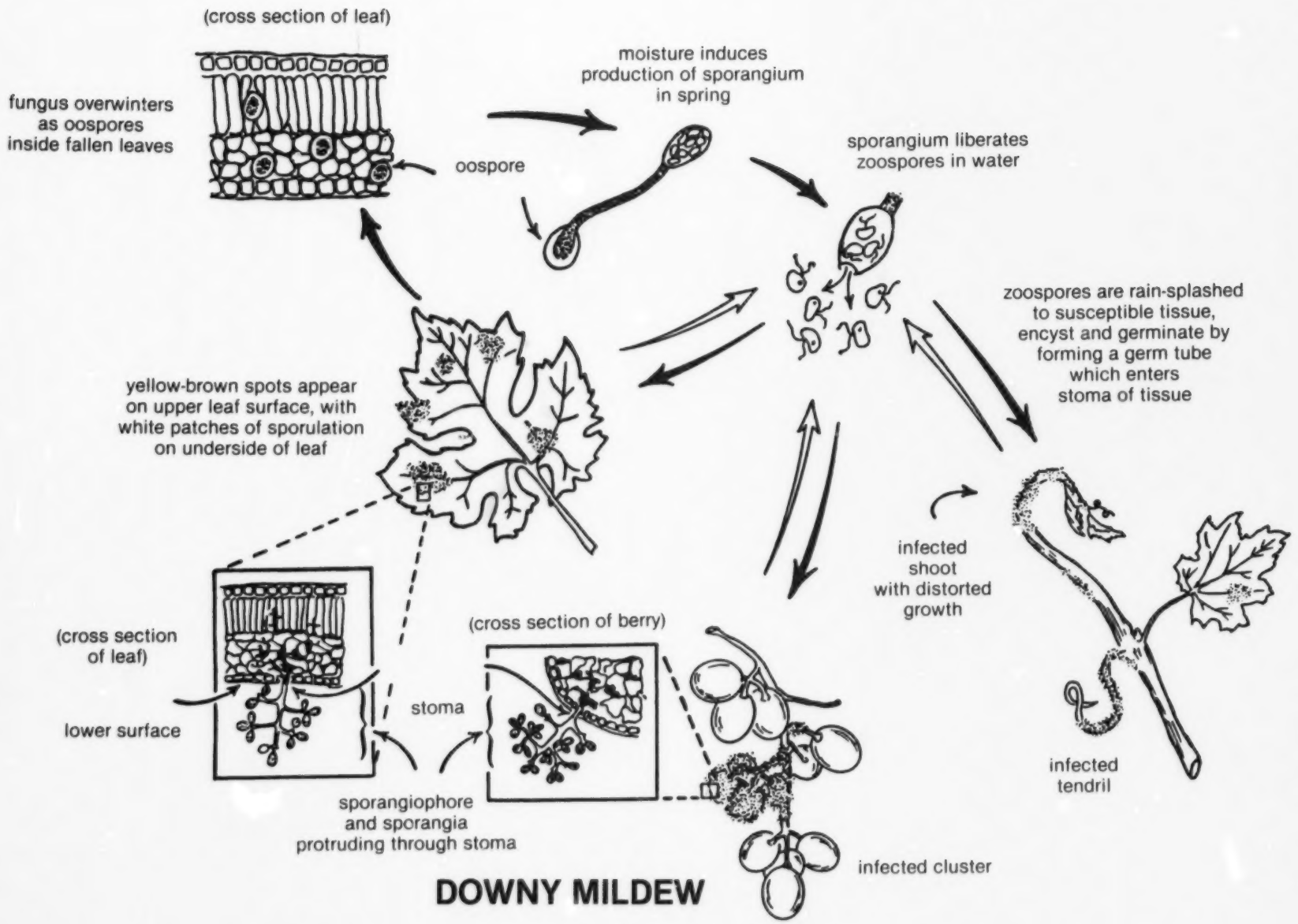


Figure 5. Post bloom cluster infection resulting in "Pig tail".

4. Late Season Leaf and Fruit infection.

Leaves infected by downy mildew often have large numbers of lesions and the leaves drop prematurely. Exposed fruit may sunscald and not mature normally. Infected berries do not soften or become covered with downy fungal growth. Instead, they turn from dull green to brownish purple and remain firm (Figure 6). The infected fruit may wrinkle and shatter (fall off) easily giving the cluster a ragged appearance.

Figure 6. Late season fruit infection causing berries to mature improperly.


(cross section of leaf)
fungus overwinters as oospores inside fallen leaves
oospore
moisture induces production of sporangium in spring
sporangium liberates zoospores in water
zoospores are rain-splashed to susceptible tissue, encyst and germinate by forming a germ tube which enters stoma of tissue
yellow-brown spots appear on upper leaf surface, with white patches of sporulation on underside of leaf
infected shoot with distorted growth
infected tendril
(cross section of leaf)
lower surface
stoma
(cross section of berry)
sporangiophore and sporangia protruding through stoma
infected cluster
DOWNY MILDEW

CONTROL STRATEGIES

Control of downy mildew is best achieved through the use of good cultural practices and proper fungicide selection. Pruning and training vines in a system that improves air circulation and promotes rapid drying of foliage will help shorten the length of potential wetting periods for infection. Proper pruning also will allow for better spray penetration and coverage during critical periods.

Crop debris should be removed or adequately incorporated into the soil early in the season to reduce the number of overwintering spores. Good weed control and proper soil drainage will reduce relative humidity and the amount of free moisture which may increase the spread of fungus.

Monitor susceptible cultivars regularly (see chart in OMAF Publication 360, *Fruit Production Recommendations)* and use effective fungicides at proper timings and rates. Key periods to monitor downy mildew are from just prior to bloom through 10 to 14 days after bloom. On extremely susceptible cultivars or where the disease becomes established early in the season, late season monitoring should be followed especially if heavy dew or foggy weather persists.

Life Cycle of Downy Mildew on Grapes (Drawing by R. Sticht, N.Y.A.E.S. Cornell University, Geneva, NY 14456)

Photographs courtesy of N.Y.A.E.S., Geneva, N.Y. and OMAF Plant Industry Branch, Vineland Station.

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